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STANDARD TIME.

At present there are said to be more than seventy distinct "railroad times" in the United States; in some single cities there are as many as four, differing from each other by amounts varying from five to twenty minutes. This state of things of course involves confusion and inconvenience to travellers, and all Americans travel. In some cases it has been the cause of serious disasters.

It is beyond doubt, then, that there would be great advantages in a uniform standard of time for the whole country. Can they be secured without too much counterbalancing inconvenience and expense? We believe they can, and without any very great difficulty.

A *single* standard for the United States (and still more, for the whole world), while in many respects highly desirable, would be exposed to the fatal objection that it would bear no relation to the true local time determined by the Sun's position. Now this local time is what we must necessarily live by. Nature compels us to work by day and sleep by night; to rise in the morning and retire at evening. A time-standard which does not recognize this cannot be practically convenient, and will never be adopted. Suppose, for instance, that Washington time were made the standard for the country; at San Francisco every thing would be three hours out of joint; and though undoubtedly, such good people as live there, and always stay at home, could, after a while, become accustomed to having noon come at 3 o'clock by their watches, and other things to match; yet there would probably be some grumbling first. Changes so radical are always hard to accomplish. But, what is worse, whenever the San Franciscan journeyed, or changed his residence, he would have to unlearn all his time-relations, and begin again.

In fact, if a uniform time-standard were adopted over the whole world, all allusions to the time of day in literature now existing, such statements of the hour as are involved in almost every accurate description of an event, would become unintelligible except by a process of translation.

The late Professor Pierce proposed a plan, which, while securing most of the advantages of the uniform standard, avoids its worst difficulties. It is to adopt, not *one* standard for the country, but a series of standard, (*four* would be needed) agreeing exactly in their minutes and seconds, but differing by entire hours. We should then have Atlantic time, Mississippi time, Mountain time, and Pacific time. Since the minutes and seconds would be everywhere the same, telegraphic signals from a correct clock would be directly available for regulating the time wherever received; the difference of one or more entire hours could never cause confusion. And yet the standard time at any place need never differ more than thirty minutes from the true local time. This amount of difference, though of course in itself undesirable, is not so great as to be intolerable in view of the attendant advantages. We hardly notice the discrepancy of fifteen minutes between sundial and clock, which occurs at certain seasons of the year, in consequence of the Equation of time.

As to the time to be chosen for the standard of minutes and seconds, unfortunately there is not yet an agreement among our astronomers. Naturally enough many think it should be Washington time, just as in England, Greenwich time is used. So far as landsmen are concerned it is really a matter of almost no importance what time is selected, but with the shipping interest it is different. Almost all nations use Greenwich time on the ocean; and for this reason it would probably be best to lay aside national prejudice, and make our Atlantic time differ from Greenwich time by just five hours; this would agree with the correct local time for a meridian passing between New York and Philadelphia. The meridian of Mississippi time (six hours from Greenwich) would then pass between Chicago and St. Louis, that of mountain time would run near Denver, and the Pacific meridian near San Francisco.

The meridian theoretically dividing Atlantic from Mississippi time would nearly bisect the State of Ohio. In a case of this sort the legislature would be likely to adopt one or the other of the two times as the standard over the whole State; so that in practice the boundaries between the standards would probably follow State lines.

The establishment of some such system need not be very difficult or long delayed.

The Signal Service proposes to receive by telegraph, from such observatories as choose to co-operate, their respective time-determinations; to combine them, and then to transmit the resulting standard-time daily to every important place in the country; besides this, at every port they would drop a time-ball, at some exact hour of Greenwich time, so that navigators would be able to rate their chronometers.

At present we have a number of more or less extensive and accurate time-services run by different observatories. But the signals sent out are more or less discordant, not unfrequently to the extent of one or two entire seconds, for the simple reason that no clock can be depended on for any length of time unchecked by star observations; and such observations are sometimes prevented by cloudy weather for several days together. Since it would seldom happen that the observatories in widely different parts of the country would all have bad weather at once, the Signal Service plan would obviate the difficulty. The most serious objection to the proposal seems really to be that the observatories which now distribute time would lose the revenue they derive from the work, unless, indeed, as would be only fair, the Signal service should continue to pay them for their observations the same compensation they now receive.

If the Signal Service can obtain from Congress the small appropriation they ask for ($25,000) to carry out their plan, and if the railroad, steamboat and telegraph companies will adopt the standard time and use it *exclusively* in their business advertisements, the thing is done. The community will follow suit and hardly notice the change.

C. A. YOUNG.

PRINCETON, N. J.

THE NEW YORK ACADEMY OF SCIENCES.

December 19, 1881.

SECTION OF PHYSICS.

Vice-president, Dr. B. N. MARTIN, in the Chair.

Thirty persons present.

A specimen of acicular hornblende in quartz was exhibited by MR. W. L. CHAMBERLAIN.

The following paper was read by Prof. W. P. TROWBRIDGE:

ON THE DETERMINATION OF THE HEATING SURFACE REQUIRED IN STEAM PIPES EMPLOYED TO PRODUCE ANY REQUIRED DISCHARGE OF AIR THROUGH VENTILATING CHIMNEYS.

To ventilate a room properly requires the frequent removal of vitiated air and the introduction of fresh or pure air, the quantity, by weight, of the air introduced and rejected being equal in a given time.

If the process be continuous, and the proper amount of air be admitted and removed every hour or minute, the only other requirements are that the entering air shall be pure, that it shall be properly warmed in cold weather, either before it enters the room or by the mixture and diffusion of warm and cold air in the room; and that the introduction and removal of air shall take place by gentle or inappreciable currents in such a manner that the pure air may be thoroughly diffused throughout the room before it is removed.

These simple rules are easily stated and comprehended. It is also well understood that to produce a movement of air requires force in proportion to the mass moved and the velocity imparted to it.

The problems which arise in ventilation consist mainly in determining the position, arrangement and sizes of the passages through which the air enters and leaves, and the proper adaptation of these passages to the forces which produce the movement.

On the correct solution of these problems, too often misapplied or misunderstood, successful ventilation depends.

The various modes of producing the movement of air for ventilation are:

First.—Ventilating chimneys or flues in which the movement is caused by the difference in weight between the heated air in the flue and the cooler air outside. This requires that the air before entering the flue shall be warmed, and the heat necessary may be that due to the heat of the room when fires are necessary for warmth; or the heat may be imparted by stoves in the base of the flues, by gas jets, or by steam heated pipes.

Second.—The movement may be produced by fans or blowers or by steam jets—the latter being seldom applied.

The object of this paper is to investigate the laws which govern the ventilation when the air is heated at the base of the flues by steam pipes, the air in its passage to the flue receiving heat by its contact with the exterior surface of the pipes. As far as I am informed these laws have not heretofore been developed, and, as this system is a very simple one, capable of very extended applications, it is hoped that the following analysis may at least lead to a full discussion of the subject:

Let it be supposed that the air in a room is to be renewed at the rate of (W) lbs per second. Suppose also that it is to be rejected through a flue whose cross-section in square feet is (A), and height in feet (H). And that it is to be heated by steam coils whose aggregate exterior surface in square feet is (S)

The following notations will be used:

W. Weight of air removed per second (lbs).

H. Height of flue in feet.

S. Exterior surface of steam pipes (sq. feet).

A. Area of cross-section of flue (or flues).

T_a. Absolute temperature of external air (found by adding to the thermometric temp. Fahr. the number 459.4).

T_c. Absolute temperature of air in the flue.

T_s. Absolute temperature of steam in the pipes.

D_a. Weight in lbs. of a cubic foot of the external air.

D_c. Weight in lbs. of a cubic foot of the flue air.

V^1. The theoretical velocity of the air in the flue.

V. The actual velocity.

r. The rate in units of heat per hour, per square foot of the surface (S) (and for each degree difference between T_s and T_a) at which the air receives heat from the pipes.

k A coefficient of loss of velocity such that $kV=V'$.

p The unbalanced pressure (upward) due to the difference of weight between the column of air in the flue and a corresponding column of external air.

Then,

$$p=H.D_a-H\,D_c \text{ or } p=H\,(D_a-D_c) \qquad (1)$$

This pressure may be represented by the weight of a column of flue air of a height—

$$\frac{p}{D_c} = \frac{H(D_a - D_c)}{D_c} \quad , \quad . \quad (2)$$

and the velocity in the flue will be found from the expression

$$\frac{V'^2}{2g} = \frac{H(D_a - D_c)}{D_c} \quad . \quad . \quad (3)$$

or,

$$V' = \sqrt{\frac{2g\,H(D_c - D_a}{D_c}} \quad (4$$

But from the Mariotte-Guy Lussac law we have—

$$\frac{D_c}{D_a} = \frac{T_a}{T_c} \text{ or } D_c = D_a \frac{T_a}{T_c} \quad (6)$$

substituting this value of D_c in formula (4) then results—

$$V' = \sqrt{2g\,H.\left(\frac{T_c - T_a)}{T_a}\right.} \quad (7)$$

In this expression the theoretical velocity of flow is expressed in terms of the height of the flue and the absolute temperatures of the flue air and the external air. From formula (7) we have—

$$T_c - T_a = \frac{V'^2}{2g\,H} \times T_a \quad . \quad (8)$$

The quantity of heat transferred to the air may be represented by

$$\phi = W.\,c.\,(T_c - T_a) \quad . \quad (9)$$

in which ϕ represents the quantity of heat in units of heat per second, and c the specific heat of air at constant pressure ($c = 0.238$.)

All of the above formulas are well known. The following are believed to be new:

The quantity of heat imparted to the air may also be represented by $\phi' = \frac{S.\,r.\,(T_s - T_a)}{3600}$ in which is the quantity of heat imparted per second, and as from the nature of the problem $\varphi = \phi'$ we have

$$\frac{S.\,r.\,(T_s - T_a)}{3600} = W.\,c.\,(T_c - T_a) \quad (10)$$

or

$$T_c - T_a = \frac{S.\,r.\,(T_s - T_a)}{W.\,c.\,3600} \quad . \quad . \quad (11)$$

combining this equation with (8) we have—

$$S'.\,r.\,\frac{(T_s - V_a)}{3600} = \frac{V'2}{2g\,H.} \times T_a \quad . \quad (12)$$

and

$$S' = \frac{V'^2.\,W.\,c.\,T_a}{\frac{2g\,H.\,r.\,(T_s - T_a)}{3600}} \quad . \quad . \quad . \quad (13)$$

This expression gives the total heating surface in the pipes in terms of the velocity, the height of the flue, the weight of air discharged per second, and the absolute temperature of the external air.

If we substitute for V′ its value in terms of V, the actual velocity, we have—

$$S' = \frac{K^2\,V^2\,W.\,c.\,T_a}{\frac{2g\,H.\,r.\,(T_s - T_a)}{3600}} \quad . \quad . \quad (14)$$

and since

$$W. = D_c\,V.\,A.$$

$$S' = \frac{K^2\,V^3\,D_c\,c.\,A.\,T_a}{\frac{2g\,H.\,r.\,(T_s - T'_a)}{3600}} \quad . \quad . \quad (15)$$

another expression for S'.

These two expressions exhibit the laws of the movement of the air, giving the quantity of heating surface required under any special conditions of area and height of flue, temperature of external air, and velocity of discharge.

The constant (r) may be found approximately from the experiments of Mr. C. B. Richards, made at Colts Arms Co., of Hartford. The constant K depends upon the frictional resistance which the air encounters in its passage into and through the flues. The velocity V may be assumed, and should not be greater than four or five feet per second. The smaller the velocity and the larger the flues, the less will be the required heating surface, and the greater the economy of the apparatus for ventilation.

The following paper was read by Prof. H. L. FAIRCHILD:

ON A PECULIAR COAL-LIKE TRANSFORMATION OF PEAT, RECENTLY DISCOVERED AT SCRANTON, PENN.

The material which we shall notice this evening has naturally been regarded, on account of its associations, as illustrating in some degree the formation of coal. A brief description of that alteration of peat which has resulted in the formation of coal, is therefore desirable.

Peat results from decomposition of vegetable matter under water. The latter excludes the atmosphere and largely prevents the oxidation, which removes the vegetable debris on the upland, and which if rapid we call combustion, or if slow, decay. In northern regions peat-swamp vegetation is commonly a sort of moss (Sphagnum) which grows upward as it dies below. Great peat deposits are also produced in lower latitudes from the debris of forest trees. The great Dismal Swamp is a fine example, and in the Hackensack and Newark meadows we have examples of peat-formations of great depth, produced by the slow subsidence of the region and the accumulation of salt-marsh vegetation.

In former geological ages, immense peat deposits were produced in the vast lowlands along the borders of the continents, or at the deltas of the ancient rivers. These great swamps were frequently submerged in the sea and deeply buried beneath mud and sand. This event occurred perhaps many times in a single locality. The buried peat slowly decomposed. Much of the hydrogen and oxygen of the vegetable tissue, and some of the carbon, were eliminated. The remainder was consolidated by the weight of the superincumbent strata, and the result is bituminous coal. Thus we have the six to twenty coal beds of Pennsylvania, or the one hundred coal-seams of Nova Scotia.

The evidence that our coals are primarily formed in this manner is abundant, clear and incontrovertible. Few subjects are by our inductive science more definitely settled than this. We find these buried vegetable deposits in every stage of decomposition and alteration. Where the containing rocks are undisturbed, lying in their original positions, the coal contains a large proportion of volatile matter, and is bituminous. But where the rocks are dislocated and folded the coal is, by the pressure and heat, changed to anthracite or perhaps to graphite. The proportion of fixed carbon, or the degree of alteration, is always proportionate to the amount of disturbance which the associated rocks have suffered. Hence anthracite coal is a metamorphosed coal, just as marble is metamorphosed limestone, or quartzyte is metamorphosed sandstone. The metamorphism of coal is still going on. The escape of the volatile matter, in which the change consists, is observed in the mines, in the production of the explosive "fire-damp," and the poisonous "choke-damp."

Running from cellulose through wood, peat, and coals up to graphite we have a complete series; the difference being the loss of hydrogen, oxygen and in a less degree of carbon. This table, after LeConte, exhibits the proportions of the elements *by weight*, the carbon being reduced to a fixed quantity:

	Carbon.	Hydrogen.	Oxygen.
Cellulose	100	16.66	133.33
Wood	100	12.18	83.07
Peat	100	9.83	55.67
Lignite	100	8.37	42.42
Bituminous Coal	100	6.12	21.23
Anthracite Coal	100	2.84	1.74
Graphite	100	0.00	0.00

Anthracite coal, it will be seen contains a very small proportion of volatile matter, and graphite none at all. No two specimens of coal from different beds or areas are likely to yield upon analysis exactly the same results. This is due to differences in degree and manner of decomposition, the varying degree of metamorphism, the varying impurities, and perhaps a difference in the kind of vegetation. Anthracite coal naturally contains more ash than bituminous, because it is more concentrated, and of course peat has the least proportion of ash, simply derived from the inorganic matter of the plant.

The substance to be described was found in a peat-bog in the city of Scranton during the past summer. It has received attention from the newspaper and scientific people of the eastern coal region of Pennsylvania; and has been recently mentioned in the *Am. Jour. of Science* for Dec. by a quotation from a letter of a Scranton gentleman to the *Engineering and Mining Journal.*

Scranton lies in the midst of the Lackawanna anthracite coal-basin, which forms the northern half of the Wyoming basin. Since the financial panic of 1872 the city has grown but slowly, and a swamp lying in the midst of the city had remained unoccupied, except as an old dumping-ground for cinders from the furnaces. The city having been lately made the county-seat of the newly created Lackawanna county, this swamp was selected as the site for a court-house. In excavating for the foundations there was found a bed of excellent peat, 10 to 14 feet deep. I visited the excavation and collected specimens from depths of 3, 5, 8, and 13 feet. These specimens, of which a series are before you, were, of course, when fresh and saturated with water, several times their present bulk.

The peat from the greatest depth was highly decomposed, or very "ripe." It was fine-grained, close in texture, and although soft held its shape well, cutting like cheese. The color, when freshly cut, was a yellowish-brown, but changed rapidly to a dark-brown, almost black, in a few minutes. Upon drying, the color becomes a lighter or grayish-brown. The rock below the ripe peat is a clayey sand. This is somewhat impervious to water; but it is likely that beneath it is a more clayey bed which originally held the water and occasioned the swamp.

In the midst of the ripe peat, termed muck in the letter above mentioned, there was found, at various times and at different places, in excavating for the division walls, a substance resembling to the eye a bright coal—anthracite if you please. This did not occur in beds or layers, or in any apparent regular manner, but in irregular scattered or branching masses. You will observe in these dried specimens how intimately the coal-like matter and the ordinary peat are mingled. The two kinds cannot be separated, and it is with difficulty that the dried material can be gotten entirely pure for purposes of analysis. It shrinks upon drying, to a greater degree than the unchanged peat. Masses which I thought would afford fair-sized dry samples have nearly disappeared. The fresh material has been described as a tough jelly, which is perhaps a fair description. It was somewhat elastic, like a mass of soft india-rubber, but would break before bending greatly. I should compare it to a very firm but brittle jelly. The fracture had the lustre of a true coal, and in the dried state the resemblance is perfect. Being found in the midst of an anthracite basin, unscientific people naturally supposed from its associations that whatever bearings it might have upon coal would relate to anthracite coal, not knowing, or not remembering, that anthracite is a metamorphic coal.

Mr N. L. BRITTON, Geological assistant at the School of Mines, New York, has made approximate analyses of this altered peat, from material which I carefuly selected; also of the peat contiguous to the transformed matter (within the distance of an inch); and of the ripe peat from a depth of 13 feet in another part of the excavation. The analyses are of thoroughly and equally dried samples, and afford the following percentages:

	Moisture at 115° Cent.	Volatile Matter.	Fixed Carbon.	Ash.
1. Ripe Peat..........	6.225	63.875	4.625	25.275
2. Peat adjacent to 3...	3.775	22 125	4.625	69.475
3. Transformed Peat...	11.350	52.800	24.725	11 125
4. Transformed Peat...	66.758	9.826	4.012	19.404

Number 4 is by the Pennsylvania State Chemist, as published in the *American Journal of Science.* The moisture is taken at 212° Fahr., and the analysis is evidently of the fresh material.

To obtain a fairer comparison, and if not strictly accurate, yet sufficiently so for our purpose, I have computed the percentages with the moisture eliminated.

	Volatile Matter.	Fixed Carbon.	Ash.
1. Ripe Peat..............	68.115	4.932	26.953 (White)
2. Adjacent to 3...........	22 993	4.806	72 201 (White)
3. Transformed Peat......	59.560	27.891	12.549 (Pink)
4. " (State Chemist)	29.559	12.069	58.372
Bituminous Coals.........	30. to 60.	40. to 70.	3 to 6

From this table it will be seen that the composition of the transformed peat, number three, is about that of a very "fat" bituminous coal, that is, one containing a large proportion of volatile combustible matter, such as are desired for making gas. In number four, the volatile matter and the fixed carbon have nearly the same proportion to each other.

The very large amount of ash in these samples is to be expected, on account of the small size of the peat-swamp, which allowed much inorganic matter to be blown or washed in over the whole surface. But the varying amount of ash would indicate that the peculiar physical character of the peat was not due to the *amount* of inorganic matter. The ash of numbers one and two was white, while that of number three was decidedly pink. This color probably indicates iron; which may possibly afford a clue to the cause of the transformation. The presence of considerable iron either inherent in the mass itself, or derived from the surrounding mass by something like concretionary action would probably hasten the decomposition; bearing upon this point, the large amount of inorganic matter without iron in the peat contiguous to the transformed peat is remarkable. The physical characteristics are undoubtedly due to the finely divided state of the carbon, mingled with the water and volatile matter. But, however produced, we have here something that is apparently coal, in the midst of peat that is not yet coal.

Except as this substance illustrates a degree or phase of peat decomposition, it is not likely to have any bearing on the formation of coal. The decomposition of a buried peat, bed under great pressure probably involves the whole mass at the same time, and does not proceed by the expansion of such centres of decomposition as are here found.

Samples have been placed in the hands of Mr. Spencer B. Newberry, of Cornell University, who is making a full chemical examination.

DISCUSSION.

DR. L. ELSBERG then said that some 20 years ago he was engaged in experiments on the subject of converting peat into coal by a more rapid process than that occuring in nature. He found that moisture, heat and pressure were, as he supposed, the elements which, together with time, nature had employed; and these three factors could and can be used really to make a very good coal. On some future occasion he would bring specimens of the manufactured coal and of various kinds of coal to the Academy, and

give an account of these experiments and the methods. For a long time his experiments were futile, because it was impossible to make a machine of iron or steel strong enough to withstand the pressure which must be applied to the prepared pulp to reduce it to coal. By the action of super-heated steam, peat is converted into a perfectly homogeneous pulp. By passage of this through any of the ordinary compressing machines used for making bricks, etc., blocks or cylinders are obtained of a substance which, so far as its economic uses are concerned, is not inferior to most qualities of bituminous coal, for gas or fuel. Every effort was made to render the bore perfectly smooth and polished in the cylinder from which the peat was finally pressed out, and for this purpose even glass and porcelain were employed. However the peat was found to be so impalpable that it was forced into the microscopic pores of the metal, and even of porcelain and glass. The peat thus inserted itself in the finest possible particles which acted like wedges, chipping off small pieces from the interior of the cylinder. No matter how fine and smooth the bore of the cylinder was made, after very beautiful working for a few days, gradually this material would insert itself in the microscopical interstices of the metal, until gradually the working of the machine was stopped or an explosion ensued. A great many trials were made and much money spent, and finally the enterprise was given up.

MR. A. A. JULIEN remarked upon the voluminous literature connected with the study of peat, and the widely varying results, notwithstanding the enormous amount of labor that has been expended. The study of this material has been approached by investigators from two economic points of view; its relations to agriculture, and its employment as fuel. In investigations of the former class the larger number of analyses have been ultimate—*i. e.*, to determine the carbon, oxygen, hydrogen, nitrogen, etc., which make up peat and its allied products. This gives very conflicting results; the slightest possible change in the amount of water, the oxidation or dissociation of the material, even while during analysis, yielding very different results even in the hands of a single investigator. The other method is approximate, simply intended for the estimate of the value of coal or peat as applied to the purposes of fuel, and is that represented in the analysis of Mr. Britton. Such analysis, however, can throw but little light on the origin of the substance; organic acid seems to be further indicated by the red ash derived from the coal-like substance (Analysis No. 3), the white ash of the enclosing peat showing the residue of silica and alumina insoluble in the humus acids.

Further, the physical characteristics of the substance described by Prof. Fairchild, its brittle jelly-like character while moist, and extreme shrinkage on drying to bright coal-like brittle flakes, are identical with those of apocrenic, humic and other organic acids. These considerations render it highly probable that this substance has been produced within the peat at Scranton merely by the leaching out of the upper portions of the bog and the concentration of soluble salts of organic acids, in part crenates, along certain planes and in small cavities within the denser part of the peat toward the bottom of the bog. There is as yet no evidence, however, that these facts have any important connection with the formation of bituminous coal, much less with that of anthracite, represented by these specimens. A third method of the examination of peat is founded upon the determination of its proximate constituents or compounds, both those of amorphous character and various organic acids. From insufficient knowledge of the exact constitution and nature of these acids, especially in their various hydrated forms, the method is very difficult and has thus far had but limited application. Only such a mode of examination can throw light upon the character of the bright jelly-like substance in the Scranton peat.

Some statements by Prof. Fairchild, however, give a clue to its identity. He has mentioned a rapid change of color in specimens of the peat taken from a depth of thirteen feet, the yellowish brown color of the surface becoming blackish brown in a few moments while being handled. This seems to indicate not the trifling change produced by drying, but the characteristic reaction of crenic acid, well known to chemists by its immediate oxidation and partial conversion into apocrenic acid. This affects not only the acid but its ordinary salts, *e. g.*, those of iron, and has been observed both in its artificial product in the laboratory, and in nature, in the deposit of iron crenate beneath peat bogs and from the waters of many springs.

Prof. D. S. MARTIN called attention to the resemblance of the lighter colored and solid variety of this peat to the darker variety of the "turba" of Brazil. In the latter he had also observed thin seams of a black bituminous substance which was much like that which occurs in this peat.

The subject was further discussed by Prof. Hubbard and Mr. Parsons.

MICROSCOPICAL SOCIETY OF ILLINOIS.

The regular meeting of the State Microscopical Society of Illinois, was held at the Academy of Sciences, No. 263 Wabash avenue, on Friday evening, December 9, 1881, President Dr. Lester Curtis in the chair. After the reading of minutes and other routine business, the secretary announced the following donations:

From Dr. Schmidt, of New Orleans, one dozen slides, consisting of nerve-fibers and other Histological preparations.

"Botanical Notes" from Prof. E. J. Hill, of Englewood, Ill.

Bulletin of Microscopical Society of Belgium, and the report of the Microscopical Society, of Liverpool.

Dr. Angier, of St. Madison, Iowa, spoke in reference to some Acari which he had found under the skin of a chicken.

Prof. Burrill, of Champaign University, was introduced and spoke in reference to the poison of the poison ivy. He took some of the exudation and found it teeming with bacteria, and he questioned whether the poisoning and the bacteria come from the plant or otherwise. The speaker stated that upon examination of the workings of the leaves, he found the same forms; the milky fluid which exuded from stem contained numbers of them and the effect of placing some of this upon h. arm had been attended with quite serious results.

The speaker went on to say that he had found the foregoing facts true with other plants among which he mentioned the chicory, buckwheat and dandelion.

Dr. Curtis described a new half-inch objective made by Gundlach and owned by Dr. J. Hollist. The glass was claimed by the maker to have an angle of 100°. Its angle had not been measured since leaving his hands.

It has the society screw and can be used on any ordinary stand. The back lens of the objective is large and extends beyond the border of the opening in the screw. This opening, therefore, acts as a diaphragm. In order to secure the benefit of the full aperture the portion of the objective can be removed and an adapter furnished with the Butterfield broad range screw can be substituted. It has also another screw of about the same diameter as the Butterfield screw, but provided with a finer thread, the name and description of this screw was not known. The front of the objective is ground down to a conical shape. For ordinary use this front is covered with a brass cap, having an aperture in the centre to allow the conical end of the objective to pass through. The cap can be removed when it is desired to use the objective for the examination of opaque objects. On removal of the cap the conical sides of the lens are seen to be covered with some sort of black varnish to prevent the passage of

outside light. A lieberkuhn is furnished with the glass which can be screwed on in place of the cap while examining opaque objects. The speaker had not had the glass in his hands long enough to become perfectly acquainted with all its qualities, it certainly is a good one, however. It resolves angulatum very satisfactory, and bears eyepiecing extremely well, working admirably on anatomical structures.

The lieberkuhn seems to be a valuable addition for some sorts of study as it brings out surface workings with unusual clearness, even in transparent objects. Mr. E. B. Stuart exhibited a Hitchcock lamp which he stated commended itself to the use of microscopists. No chimney is required, it being a blast lamp, the flames of which is fanned by a passage of air from the bottom, the top of the lamp driven by a noiseless clockwork. The oil well is entirely separate from the outside part of the lamp, and is kept cool by the cold blast of air constantly surrounding it. It gives a light of about a six-foot gas burner and the flame is steady and more free from flicker than gas or the ordinary carbon burner. He also showed under the microscope specimens of the gelatine-bromide plates for photographic work, that had been submitted by a photographer as imperfect. An inspection under the microscope showed three kinds of spots. One caused by dust particles which had settled on the gelatine while still soft, and as the emulsion hardened, became firmly fixed on the plate. The second kind of spots were caused by, apparently, the solvent action of some substance on the film, as it could be seen to be less dense at those points, while the third were thicker and evidently caused by carelessly spattering the emulsion on partially dried plates.

The meeting was then declared informal.

WM. HOSKINS, *Secretary*.

THE AMERICAN CHEMICAL SOCIETY.

The papers appointed to be read on the evening of the December meeting were, owing to the election of officers, omitted and therefore at the *Conversazione* held on Dec. 16 they were again brought up for consideration.

The first and second papers were "On the Separation and Estimation of Manganese" and "On a Modification of Mohr's Burette; adopting it to use in delivering corrosive solution" by Nelson H. Barton. Both of these papers consisted of descriptions of details of manipulation which the author had been lead to use in his own laboratory resulting from his experience and which under favorable considerations might be desirable to employ.

The third paper was by Mr. Casamajor and titled "Analysis of Soghum Juice" an enumeration of the results obtained by him in his laboratory with comments on them.

"A new Laboratory Filter and Aspirator" was the next paper, also by Mr. Casamajor. The apparatus referred to has recently been patented, and in the above paper it was thoroughly described and a model exhibited. The fifth paper was by Dr. A. R. Leeds, entitled "A Chemical Inquiry into the Self-purifying Power of a Flowing Stream." In this paper the complete results of the work done by Dr. Leeds for the New Jersey Board of Health were presented. It will be recollected that in a previous number a synopsis of this paper was given to the readers of SCIENCE. On the present occasion charts were exhibited showing the exact relations existing between the various estimations which were made. These were peculiarly interesting to chemists although unfortunately the entire subject of water analysis is in such a state of confusion that it is difficult to make much headway in the accumulating and conflicting mass of literature which is current on this subject. The entire paper of Prof. Leeds will be published in the N. J. Board of Health Reports. The final paper of the evening was "A New Method for the Analysis of Mustard" by the same gentleman with the assistance of Mr. Everhart. The ordinary methods given by Hassall, Blyth and others were so unsatisfactory in their results that an effort was made to produce something more definite. After some little study it was found best to separate the various constituents by different extractions with various reagents, so that an addition to the conventional determinations of moisture, oil and ash (for the mineral adulterants) extractions of alcohol and ether are made for the remaining ingredients.

M. B.

SUICIDE, an Essay on Comparative Moral Statistics. By HENRY MORSELLI, M. D., Professor of Psychological Medicine, Royal University, Turin. Being abridged from the original, as Volume XXXVI of the International Scientific Series. New York. D. Appleton & Co.

The present moment seems peculiarly favorable to the presentation of a work on the subject of suicide. Whether it be the great accumulation of financial and political crises, or the increase of mental derangements, or a fundamental change in the *morale* of the civilized races, it would seem as if a great suicidal wave was sweeping over our social horizon. The labors of Buckle, Wallace and Bagshot have taught the necessity of studying such complicated problems synthetically. The statistics of no one community, the analysis of no one cause, will suffice to explain their phenomena. Professor Morselli, fully recognizing this fact, has undertaken a study of the question of suicide from a statistical point of view, and one involving in its analysis the results of Social Scientific, Anthropological, and Medico-Psychological inquiries.

The first fact demonstrated by a careful study of statistics is the regularity and the increase of suicide in civilized countries, which finds its expression in the painful conclusion, that "in the aggregate of the civilized States of Europe and America, the frequency of suicide shows a growing and uniform increase, so that generally, voluntary death since the beginning of the century has increased and goes on increasing more rapidly than the geometrical augmentation of the population and of the general mortality."

Among individual elements serving to explain this increase of suicide, climate deserves the least prominence as a direct factor. The only ascertained fact in this direction is that in the centre of Europe on an area of about 942,000 square kilometers comprised between 47-57° of latitude and 20-40° of longitude, are found the people who manifest the greatest inclination to suicide. The least amount of suicide is found on the isothermal line of + 17.° 5 C, running through Portugal, Spain, Italy, Corsica and probably Greece. That the mere feature of temperature is not a very important one, is shown by the fact that on the isothermal line of + 10° C, there is the greatest variation. In the United States for example the suicidal rate is 35 per million; in Ireland 16, in England 67, in Belgium 55, the Netherlands 35, Hanover 140, Prussian Saxony 228, Galicia 98. A more direct and constant relation is found with other cosmical influences, thus the regions of the great rivers are most afflicted by suicide *coeteris paribus*, while on the contrary marshy or excessively low lands, like the Landes in France, the low countries about the Zuyder Zee and Jutland, show a lesser proportion. That suicide is most frequent in the warm seasons, is confirmed by Morselli, this observation is a familiar one to New Yorkers. In our city a perfect suicide *furore* occurs in certain summers, and the direct influence of the heat has no doubt much to do with this as with the summer increase in violent crimes similarly the results of insanity or passion, a fact to which, however, no reference is made by the author before us. It is certainly a noteworthy fact, in which he confirms Guerry, that the maximum of suïcide falls under the summer solstice, the minimum under the winter solstice.

The most interesting portion of the volume, is the one relating to the influence of race and nationality as determining the suicidal rate. We have always believed that a most important contribution to the elucidation of the problem of suicide could be made from this side of the question. And it is to be regretted that the talented writer before us has not added to the numerous tables, which render his volume, a mine of valuable information, one showing in four columns, the name of the nation, the proportion in same per million, the proportion of each form of insanity, and the suicidal rate. We believe that a noticable parallelism would be observed in these columns. The Germanic race preponderates over all others, and the German and Scandinavian branches divide the supremacy. The Anglo-Saxon stock has, however, gained by its long separation from the German mother, and its admixture with other races, for its suicidal tendency is much smaller. The Celto-Romans, on the whole, show a small suicidal rate, this increases, however, with the geographical approach to the Germanic borders, and the fact is of startling interest, that as keen an analyst as Morselli, attributes the higher suicidal rate in France and Belgium to the remote, continuous and the in modern times as persistent invasion of German elements sweeping up the valleys of the Scheldt, Seine, Somme, Meuse and even that of the Loire! The lowest suicidal rate is found among the sclavonic peoples. Morselli in this part of the work fails to refer to the fact that the Bohemians, isolated from the sclavonic parent stocks by an ocean of German States, have lost the relative immunity of suicide, just as the Anglo-Saxons have gained in this respect by separation from the "suicidal" race. The general conclusion, however. would seem to be flattering to the nations having most suicides. Savage peoples commit suicide only under the stress of hunger, but as civilization progresses a thousand new motives arise, with the mental needs. The reflection is not made directly by the author, but it can be read between the lines, that a similar reason accounts for the lesser proportion of suicides among Catholics as compared with Protestants. Judaism has a very favorable influence; but this is an exceptional instance, it being the only religion tied up in a single race. A very interesting fact, is that other conditions duly considered, the votaries of that creed which is in a great minority in a given country, show a lesser number of suicides; the reason given by Legoyt is that the intolerance of the surrounding population exercises a sort of moral coercion, making the dissenters desirous to avoid giving any excuse for harsh criticisms.

As to social influences, it is concluded from the general parallelism of suicide and criminality that a deterioration of morals is favorable to suicide. To this there are however some marked exceptions, especially in southern Italy, where grave crimes are common and suicide is rare, and a revision of the question induces Morselli to modify the conclusion ordinarily held by saying that in those countries "where crimes against property predominate, suicides are more frequent than where crimes of blood are frequent." Remarkably enough it is found, with regard to the influence of economical conditions, that it is not the exact period of economical crisis, but a subsequent one that shows an increase of suicide. The influence of the Austrian crisis of 1858-1859 was shown by an increase of suicides in 1860-1861. The Franco-Prussian war of 1870-71 led to more suicides in 1872-1873.

Without any question the most interesting part of the volume consists in its appended "suicidal" maps. These are maps of Europe and of the individual European countries, exhibiting by the intensity of shading, the proportion of suicides in the population. On glancing over the map of Europe it is seen in a moment, that the highest proportion is found in Saxony; in the neighborhood of Paris and of Vienna. It is not alone race but also the density of the population which exert an important influence here, and as the contest for existence naturally culminates in the destruction of the weak, the only advice the author is able to give as a preventive against suicide, is "to develop in man the power of well-ordering sentiments and ideas by which to reach a certain aim in life; in short, to give force and energy to the moral character."

While we venture to regard this advice as a fruitless one, believing that in view of the author's earlier conclusions expressed in the same volume, all the good advice and training that might be given would not materially change the suicidal ratio. We can only commend the perusal of the work to the reader as alone calculated to furnish an adequate conception of the vast array of useful facts gathered by its author, illustrative of many profitable lessons in sociology and ethnology. That in a treatise dealing with the statistics of so many lands and with authorities who have written in so many tongues, an occasional error should creep in, is not to be marveled at, and it is only where such errors are made the basis of conclusions that the reviewer considers it his duty to call attention to them.

It is stated, in speaking of the influence of religion on suicides, that in Saxony half the population are Catholics. The fact is that Saxony is one of the most intensely Protestant countries in the world, the stronghold of the Reformation, and a land in which the slight vestige of Catholicism (not consisting of one-twentieth of the population among its votaries), is only maintained by the court which is Catholic since the time of the libertine, Augustus the Strong. ED. C. SPITZKA.

THE SUN: by PROFESSOR C. A. YOUNG, with numerous illustrations. International Scientific Series. D. Appleton & Co., New York, 1881, pp. 321, 12mo.

It is an extremely fortunate thing when we have a book on a special subject, written by a man who has himself made capital discoveries in this subject and who, at the same time, has a culture wide enough to appreciate the philosophical relations of his special subject to science in general.

If at the same time the whole exposition is written in a graceful style, perfectly plain and easy to follow, and dignified as well, we have special reason to be grateful. Professor Young is the descendant of a line of professors, and lucid exposition is natural to him, as we find from this work. It is not necessary to say that in the other degrees mentioned Professor Young is precisely the one person to whom we should first look as authority.

There are certain things which an author can best say for himself. In Professor Young's preface we find this: "I have tried to keep distinct the line between the certain and the conjectural, and to indicate as far as possible the degree of confidence to be placed in data and conclusions."

Throughout the work we have found this carried out consistently, not as a task, but as a natural outcome of the author's method of thought.

The work opens with an introduction which treats of the sun's relation to life and activity upon the earth. In this section (page 18) the accepted beliefs with regard to the sun's constitution are laid down. This is a point of departure.

Chapter I. deals with the distance, dimensions and mass of the sun. The low density of the sun is quoted as showing the strong probability that the sun is mainly a mass of vapor or gas, powerfully condensed in the central portions by the superincumbent weight, but prevented from liquefaction by an exceedingly high temperature.

Chapter II. deals with the methods of studying the solar surface.

Chapter III. relates to the Spectroscope and to the solar spectrum in general.

On page 87 we have a table of the twenty-two elements

which are present in the solar atmosphere. Oxygen is included. Nitrogen is not. The point is here made that the elements *not* present in the atmosphere of the sun are precisely those which are most common on the earth, and Mr. Lockyer's *dissociation* explanation is given and a very full and fair statement of the reasons for and against it.

We would have been glad to see in this place an examination of a paper by Dr. Hastings in the first number of the *American Journal of Chemistry*, in which the writer attempts to show that Lockyer's hypothesis is entirely untenable, and in conflict with received kinetic theories of gases.

The fourth chapter deals with the sun spots and the solar surface. In this chapter is quoted a very remarkable account of the phenomena attending the growth and decay of a sun spot, written by that veteran observer of the sun, Dr. Peters, of Hamilton College. A foot note to page 137 suggests a most interesting research in relation to the acceleration or *drift* of the spots in longitude, and it is in such suggestions as this as well as in its general views that the book will owe its great value to the astronomical student.

Chapter V. deals with the periodicity of sun spots and with the theories as to their cause and nature. "On the whole," Prof. Young says, "it seems probable that the cause of the periodicity is in the sun itself" and is not due to external causes. The relations of sun spots and climate are discussed completely, yet briefly. Professor Young is one of the few English speaking astronomers who can keep his temper upon this subject.

In giving the various theories as to the cause and nature of sun spots, the author deserves our thanks for a few very simple diagrams, for the want of which many of us have gone astray in reading the sun spot war records in the *Comptes Rendus*.

The next chapter deals with the chromosphere and the prominences, their appearances and the theories of their formation and causes.

In dealing with the lines of the chromosphere spectrum we have two lists: First, those always present, and, second, those readily seen by suitable manipulation ("on slight provocation"). The catalogue of 273 lines seen by Prof. Young at Sherman in 1872 is not given here. The discussion of the causes of the great velocities observed in prominences on pages 211, 212 is especially interesting and suggestive.

Chapter VII. is upon the Corona—its phenomena and the theories of its cause. The figure on page 225, with its explanation on page 215, appear to the writer to give too much weight to observations of a streamer in the direction of the sun's poles at the solar eclipse in 1878. It is not impossible that such a streamer existed, but it seems at any rate very improbable in the light of the photographs given in the Eclipse Volume of the Naval Observatory.

Chapter VIII. on the sun's light and heat is a rapid survey of the important work which has been done on these subjects. The light is first considered, and an expression for the sun's light in candle power deduced.

Prof. Langley's interesting comparison of the light of a Bessemer Converter to the sun's light is quoted as showing the brightness of the sun to be over 5,000 times that of the glowing metal. The positive carbon of the electric arc is from two to four times fainter than the sun.

The light from various portions of the sun's disc is next considered, and the absorption of the light near the limb brings us to the question of a solar atmosphere.

This solar atmosphere has usually been considered as gaseous, but the author quotes Hastings' lately proposed theory that this absorption is produced by matter in a pulverulent condition at a lower temperature than the photospheric clouds and dispersed through the lower portions of the sun's true atmosphere.

"If the sun's atmosphere were removed, its brightness would be increased several times. It is almost certain that the amount of light received by the earth would be doubled; it is hardly likely that it would be quintupled."

The data as to the sun's heat are more precise; and the results of experiments (fully described) are put in a striking way. The sun would meet in a single swing of the pendulum a solid column of ice 2¼ miles in diameter and 93,000,000 miles long, provided his whole power would be concentrated upon it. What is the source of this enormous energy which amounts to something like one horse power *continuously* acting to each thirty square feet of the earth's surface? Simple combustion of any matter which we know would not suffice to keep up the the sun's heat for any length of time. The *effective temperature* of the sun is next considered, *i. e.*, the temperature which a uniform surface of lamp black of the same size as the sun would have to keep, in order to radiate the same quantity of heat as the sun itself. The results of Rossetti (18,000° Fahr), are quoted with approval. The two most important theories as to the way in which the solar heat is maintained—the meteoric theory—and the contraction theory are next examined. Both causes are undoubtedly operative. Probably the contraction of the sun is the most effective agent. If this theory be accepted then the sun has a limited future as well as a finite past, so far as we can now see.

Chapter IX. opens with a valuable table of numerical data relating to the sun—a table of statistics for the solar globe.

The constitution of the solar nucleus and atmosphere with an examination of various theories of this constitution constitutes the main portion of this chapter, which closes with the statement of some of the more important and immediate problems of solar physics.

The usually received theory of the constitution of the photosphere is given (p. 290) and the first authoritative criticism of the recently proposed theory of Dr. Hastings is given on pp. 291-294. It seems to the writer, however, that Prof. Young, in urging as an obvious objection to this theory, that whatever is precipitated at a lower temperature than is the photosphere element must increase the depth of the photosphere, has overlooked an essential point of the argument. The photosphere substance is supposed to have a much higher vaporization temperature than those of other elements, *e. g.* iron, therefore any precipitated iron belongs, not to the photosphere, but to the over-lying "smoke" envelope.

This chapter closes the work proper of which we have been able to give but the barest outline. Its chief characteristics seem to the writer to be: perfectly clear statements of the facts of observation and what is far more valuable, of the theories to be considered. These are made definite by every way possible—by lucid statements and by diagrammatic figures; candid discussion of these facts and theories in the light of the best information now attainable; and lastly the drawing of the most certain conclusions which are possible from the data, taking care in each case to give a proper idea of the degree of certainty which our present knowledge allows.

These are high excellences and make the book a most important one. In pointing them out the writer has done no more than any reader can do for himself.

EDWARD S. HOLDEN.

M. COCHERY intends to spend the surplus of the Electrical Exhibition, which is said to exceed 16,000*l.*, in establishing a research laboratory for electricity.

PROFESSOR HAECKEL is at present in Ceylon, where he is to stay for three months making a scientific exploration of the island.

STEAM AND HYDRAULIC SAFETY ELEVATORS.

In large cities, where every inch of land is precious, the modern power elevator has virtually effected for building, what the locomotive engine has effected for travel and transportation—namely, a revolution. Hotels, office buildings, apartment houses, and first-class stores, are now almost invariably carried to a height of eight or ten stories, and equipped with elevators; while a tendency is fast growing and will soon become controlling, to increase the value of third and fourth rate property in the same way, and even to eliminate the toil of stair-climbing from ordinary housekeeping. This great change in the conditions of living, together with the progressive fatality already developed, as elevators without adequate safeguards begin to wear and weaken, will soon be calling in terrible tones for legislative interference. Fortunately, there are standard safety appliances that have stood the test of every possible description of breakage and accident to which elevators are liable, during a quarter of a century past, without a single failure. The sole reason that we hear from time to time of cruel destruction to human life from the falling of elevators in our hotels and apartment houses, etc., is that there are proprietors too parsimonious, or too ignorant, to provide their buildings with the perfect and proved safeguards that are everywhere before their eyes in the standard pattern of elevators used in nearly all of the most valuable buildings. They ought to be compelled to do so, whoever may profit or lose by the requirement. Meanwhile, let us see what individuals can do to protect themselves against these people by avoidance.

The improved modern safety device, introduced by Otis Brothers & Co., in their best elevators, for some years past, is quite outside and independent of the other mechanism, and acts instantaneously by virtue of any acceleration of the standard rate of motion in the car, from whatever cause. Both arrangement and action are simplicity itself. There is an independent sheave at the top and another at the bottom of the hoist well or shaft, and an endless wire rope running around the two; the lower sheave being suspended, to keep the rope taut. The rope is connected at a proper point with the safety catches on the car, in such a manner as to run the rope as the car moves, and thus to run a pair of governor balls geared to the top sheave. If the car should commence descending faster than the rate for which the governor is set – whether by accident, by overloading, or by indiscretion of the operator—the extension of the governor balls by the accelerated motion (greatly multiplied on the governor) instantly operates a clutch on the rope which pulls out the catches into the safety ratchets, and stops and locks the car in its place. It is like an automatic iron hand, always ready to clutch and pull the rope that arrests the car, the moment it disobeys the set restriction on its rate of descent. It is literally impossible by any means to move the car downward faster than the rate prescribed.

HYDRAULIC ELEVATORS.

For the purpose most interesting to the general reader —that of passenger elevators—the very recently perfected application of hydraulic power has controlling advantages, and it is probable that most pasaenger elevators will hereafter be constructed on this principle. The best hydraulic elevators are preferred to steam for this purpose on account of the perfect smoothness of their motion, their remarkable simplicity of construction and operation, easy management, and reduced opportunities for breakage, derangement or accident. To these advantages they add that of reduced expense for motive power to the extent of the head of water available on the premises. It is not to be understood, however, that all hydraulic elevators share in this preference. Most kinds heretofore, in fact have cost more in wear and tear of ropes and other parts, and in motive power to overcome extra friction, weight, &c., than any kind of steam elevators.

We shall make it our object to put the reader in possession of the leading criteria and principles necessary for a correct judgment among different hydraulic elevators in the remainder of this article.

Generally the less desirable kinds of hydraulic elevators are made with a short cylinder of large diameter, into which the pressure of a heavy column of water is introduced at one end, urging a solid piston like that of a steam engine from that end to the other. The piston rod pushes forward a crosshead bearing on each side of it a block of multiplying sheaves or pulleys around which the wire rope (from the sheave at the top of the hoist) passes, and returns many times to and from a similar pair of multiplying blocks in a fixed position at the rear of the cylinder. As these blocks of sheaves are thus forced farther apart by the motion of the piston, lengthening each of the twenty turns (more or less) of the wire rope between them, a length of rope many times the length of the piston stroke is obviously thus taken up, and the car is hoisted an equivalent distance. It is the same in effect as winding up the rope on a drum: but it is not so favorable in mode; the friction and strain being excessively increased. Moreover, the course of the wire rope from sheave to sheave in the blocks, must necessarily cross the plane of revolution of each sheave, both in taking and leaving it, so that the edge of every groove continually and severely rasps the rope as it runs into it and out of it under a tension of tons force. In point of fact, these ropes have to be frequently renewed, not only at considerable expense, but at much inconvenience from interruption. But a worse result is their great liability to snap suddenly at some point, and not only throw the enormous tension out of balance and the labyrinth of rope and blocks into violent snarl and wreck, to the destruction of everything animate or inanimate within reach; but at the same time, to cause the car to fall the whole distance to which it may have been raised. Another objection, of course, is the constant extra cost of power for the extreme friction peculiar to this mode of multiplying motion. The substitution of a rack of cog teeth on the piston rod, gearing into a pinion wheel, and that into a geared winding drum, does not mend the matter in point of safety or economy, since it is not practicable to use a belt from so slow a motor. Some of this class of machines are made doubly objectionable by placing the cylinder horizontally. The lift weight of a vertical piston can be counterbalanced; but this arrangement makes a nett increase of friction by the dead weight of the heavy piston to be dragged on the bottom side of the cylinder. Two other disadvantages are not to be avoided or counteracted: the constant wear of the cylinder and piston out of round by dragging the latter on its under side, and the accumulation under it of sediment from the water, to assist in the work of abrasion.

We conclude with a description of the more modern and matured form of hydraulic elevator, adopted for the Government buildings, on the unanimous recommendation of a board of experts appointed by the Secretary of the Treasury, and composed of Messrs. Frederick Graff, C. E., of Philadelphia; Master Machinist Geo. A. Wilson of the Washington Navy Yard; and Chief Examiner J. B. Durnall of the Patent Office. Their decision was made after exhaustive investigation in the principal cities and manufactories; and from the fact that out of nine competing methods only one was considered worthy of mention in their report, and that in terms of almost enthusiastic admiration, the reader may judge that the relative objections and advantages are fairly stated in this brief review. Six of these elevators have been running for three years, uninterupted for repair, in the "Boreel" and "Morse" buildings, and similar ones are going up in other famous piles, such as the "Vanderbilt," "Mills,

"Kelly," &c. All of the United States buildings having elevators, and in short, nearly all the most valuable public buildings, hotels, fashionable stores, apartment houses, &c., to the number of thousands, in this and other American cities, contain specimens of hydraulic or steam elevators of the same admirable manufacture.

The new hydraulic elevator is indeed a prodigy of simplicity and automatic power, with simple gravitation of air and water for its only law and mode of action, and with a conspicuous absence of the objections heretofore observed, as well as of all others conceivable. It consists of an upright cylinder and piston, only about a foot in diameter, and half the height of the lift; two pipes and two valves. That is all, save the car with its hoist ropes and sheaves, and whatever means, natural or other, may be used to bring a head of water into connection with the cylinder. One of the two pipes is a circulating pipe which connects the two extremities of the cylinder, and affords a passage for the transfer of water from one end to the other—that is, from above the piston to below it. It is also the medium for the pressure of water from the other or hydraulic pipe; a pressure thus made at all times continuous and uniform on the top of the piston head, wherever it may be, in motion or at rest. This pressure (when not neutralized) forces down the piston, thereby drawing up the car by the hoist rope attached to the piston rod.

Let us first suppose the car at the top of the lift, and the piston consequently down at the bottom of the cylinder; or, the car stationary at any point in the lift, and the piston at a corresponding point in the cylinder. As the cylinder is always full of water, and the full head of pressure always on, wherever the piston may be, the only possible way for the piston to move in either direction is for the water to get out of its way through some outlet. To let the piston rise (pulled up by the weight in the descending car) it is only necessary to open a valve that closes the lower end of the circulating pipe, thus opening communication from the part of the cylinder above the piston to the part of the cylinder below it. This allows the water above the piston to be pressed out before it, and down and back into the cylinder under it. The steadiness and ease with which the piston follows up the receding water—which, in turn, follows it up as steadily beneath—can not be exceeded by any movement in art or nature. At the same time, the movement is graduated perfectly to the will of the operator, whatever the variation of load, by opening or contracting, more or less, the valve orifice through which water is transferred from the top to the bottom of the cylinder. No water is expended.

Finally, to force down the piston and hoist the car, the circulating valve before mentioned must, of course, be closed; but this only renders motion either way impossible, because an immoveable body of water without vent fills the cylinder both above and below the piston, and it might as well be solid iron, for the matter of allowing the piston to stir. Another of the simplest things in the world must be done, namely, to open a discharge valve from the lower part of the cylinder, when the water there, in flowing out, begins not only to make room for the descent of the piston, but to make a vacuum beneath it which brings the atmospheric pressure upon the top of the piston, in addition to the pressure of the hydraulic column, which is never withdrawn. The descent is the same perfectly balanced, steady, soft and *fluid* motion previously noticed in the ascent; graduated likewise to perfection by controlling the size of the orifice with the valve rope in the hands of the operator in the car. The symplicity of the valve motion is also very beautiful. The two valves are simply two plugs a few inches apart on one stem, fitted inside a pipe, and drawn up or down by an easy motion of the hand rope. They are so adjusted with the orifices of circulation and discharge, respectively, that while they are at an intermediate position, all motion of water, and consequently of piston and car, is blocked; if lifted, they gradually and simultaneously open the discharge and close the circulation orifice, as much or little as the operator pleases, causing and graduating descent of piston and ascent of car; or if lowered, they cut off dicharge absolutely, and open circulation as gradually as desired, causing ascent of piston and descent of car.

The multiplication of the piston motion two or three fold in that of the car (which is all that can be necessary in the highest buildings with these long-cylinder machines) is done by single pairs of sheaves, and consequently without making the ropes cross the plane of revolution of their sheaves, and therefore without special friction, as well as without special strain and wear. All moves easily, naturally, straightforwardly, imperturbably, like the silent music of the spheres. The power, unlike that of steam, is as definitely limited and as invariable under all circumstances as the weight of so many cubic feet of water, with which the entire motive apparatus is exactly filled at every moment, never a drop less or a drop more, or the space of a drop vacant. The chances of breaking anything are reduced to a minimum so remote as to be hardly more than metaphysical; and yet all the standard safety appliances stand on guard against that conceptual possibility, so that there is probably no other kind of vehicle or mode of motion on sea or land so safe as that of the new hydraulic elevators above described. It is estimated that thirty millions of passengers are now annually conveyed to and from the upper stories of buildings in the elevators recorded on the salesbooks of Otis Brothers & Co. Up to the present time, this inconceivable amount of passenger business has been performed without a single reported instance of injury to life or limb from the failure of any part of the machinery. The fact is, so far as we know, without a parallel in the history of machinery, and may well direct earnest attention not only to the general qualities, but to the special features, of these remarkable machines.

OXIDIZED OIL.

To welcome a new industry is always an agreeable task, but special interest is attached to those instances in which the application of scientific principles have contributed to the results.

We have now to record a few facts relating to a means of manipulating oils, which result in the formation of a substance which has many of the advantages and characteristics of Rubber, but which can be manufactured at a fraction of its cost.

Reduced cost in the manufacture of a staple article, where a monopoly can be secured, naturally suggests great profits, and as capitalists are now competing for the privilege of manufacturing this new material, a few words respecting its nature and properties may be acceptable to our readers.

A few years ago a man of studious habits and inventive genius noticed that around the mouth of a can of oil, the oil had acquired the property of solidity, and finding that the effect was due to the oxidation of the oil, he conceived the idea of turning this property of linseed oil to practical account for various purposes in the Arts and Manufactures.

Mr. Frederick Walton, (for that was the name of the gentleman to whom we have referred) occupied several years in studying this subject, and making practical experiments relating to the behavior of oils under various conditions, and at length arrived at such successful results as to warrant his reading a paper before the London "Society of Arts," entitled "Introduction and Use of Elastic Gums and Analogous Substances." In this paper, after discussing the sources and qualities of india-rubber and gutta-percha, he described a method which he had invented of manufacturing an artificial product, which not only possessed the principal qualities of Caoutchouc and

of the gum of the Para tree, but which was considerably cheaper and had a wider application. The principal feature in the new process was the oxidation and consequent solidification of linseed oil. He found that linseed, nut, and poppy oil possessed the property of becoming concrete on exposure to the atmosphere, and that when spread in a thin layer, on a surface of wood or iron, they dried or changed into a thin skin.

This change is of course produced by the absorption of oxygen and the disengagement of carbonic acid. The power of absorbing oxygen rapidly is inconsiderable in the crude or raw linseed oil, but is greatly increased by boiling the oil, which is best effected by exposing a large quantity of raw oil to a strong heat in a cauldron, with a small percentage of metallic oxide of lead. In this condition it is called varnish, and has a viscid character. A layer of this oil requires from six to twenty-four hours to change into a skin-like substance, according as the state of the atmosphere is more or less favorable.

One of the first materials placed upon the market by Mr. Walton as the practical result of his experiments was a new floor cloth which he called Linoleum. This material has for its basis oxidized oil, which is mixed with a tenacious substance, to which is added finely powdered cork. The material thus formed is passed between rollers and pressed upon a fibrous texture.

The advantages of Linoleum over the previous oil cloths was apparent, for it was waterproof, a non-conductor of heat, while its natural body color permitted the addition of an agreable and artistic decoration. The manufacture of Linoleum has been a great success, and has realized large fortunes to its original promoters, and fifteen years after its introduction was still paying 60 per cent as a dividend.

Linoleum may described as the first and crude result of Mr. Walton's expensive experiments with oxidized oil; he had however in reserve a higher development of his ideas, and at length produced a material which is a refinement of all his previous efforts.

Lincrusta-Walton, as its name implies is made from oxidized linseed oil which is skillfully manipulated with various substances, forming a material posessing most valuable properties and its principal characteristics appear to be unique.

Unlike Linoleum, which is adapted to one purpose alone, the application of Lincrusta to the Arts and Manufactures is most varied, and we shall soon find it in every house under so many forms that its future as a staple commodity is assured. One of the most valuable properties of Lincrusta lies in the fact that although originally so soft as to receive the most delicate impressions, it hardens within a few hours and permanently remains in that condition. It is a waterproof material with a natural color of a neutral shade, which can be changed in manufacturing to almost any tint. Lastly the manufacturer, by manipulating the cement, has it in his power to produce many modifications of the material, and, as we shall presently show, can make various substances which have a very wide application, and which will undoubtedly supersede many valuable monopolies, on account of its being both cheaper, more permanent, and possessing many advantages over its rivals.

Perhaps one of the most important adaptations of Lincrusta is a new and improved covering to walls, and as such it appears to us a perfect decoration. For this purpose the Lincrusta is passed through machines which leave an elegant design *in relief* upon its upper surface, and at the same time is pressed upon a thin backing of muslin or paper. Thus manufactured and hung as a wall paper in its natural tint, it is the most beautiful mural decoration known, and when colored or hand-painted the most varied effects are produced; it may present the appearance of a rich old tapestry, or the subdued tones of stamped leather. Combined with the gilder's art the brilliant effects of embossed metal in solid relief are obtained. The only limit to its development in this respect is the art of the designer and the skill of the die sinker. Bearing in mind that combined with these advantages we have a material as flexible as leather or even rubber; resilient, standing blows without injury, enduring and tough, not easily torn, waterproof and unaffected by temperature, and withal capable of being produced at a price below even the medium quality of relief papers, and it is clear advantages are combined in Lincrusta that will make it one of the most valuable products which can be manufactured, and one which will be of universal use.

The special use of Lincrusta in the United States as a wall decoration will be at once recognized, as its warmth and resistance to damp makes its application almost imperative in the case of frame buildings which form the majority of dwellings in this country.

Of the other applications of Lincrusta to the Arts and Manufactures, our reference must be brief, for they appear endless in their variety. Among other purposes Lincrusta can be used as an excellent covering for external walls. For bookbinding it takes the place of carton-pierre and papier-mâchè, and even excels leather in its capability of receiving fine and incisive ornament. Mouldings of Lincrusta can be gilded with facility, and attain a hardness equal to wood, and can be applied in this form to picture frames, cornices, panels, mantelpieces, or any kind of furniture.

For wall advertisement-placards Lincrusta has many advantages, the letters are in relief, and neither sun, rain or damp has any bad effect upon it.

Railway and other traveling cars will in future be decorated with Lincrusta, and its application in steam ships is acknowledged, having been largely used in the new Cunard ship *Servia*, which recently left our port. In this instance the builders state that it gave the greatest satisfaction both to the owners and to those who inspected the ship.

Lincrusta-Walton may be applied to many other purposes than those already enumerated, but the above are amongst the most important and offer an almost unlimited field for manufacturing and commercial enterprise. In short, all decorations executed up to the present time on *flat* surfaces, that is to say *without* relief, can now when desired be fashioned *with* relief, and their artistic value and appearance may thus be considerably augmented.

Among the art exbibits now to be seen in New York, that of the Lincrusta at 41 Union Square, corner of 17th street, is perhaps the most attractive. Specimens of the material have been imported from London and Paris and are here shown *in situ* and have elicited the admiration of all who have visited the rooms. The material is not yet for sale, and the exhibit has been made merely to show the public the wonderful effects of this beautiful material, by Mr. John R. Whitley, a gentlemen who has largely interested himself in this matter, and who is now making arrangements to give the American public the benefit of this manufacture.

If our description has aroused an interest in this subject, we would simply state that the exhibit is open to all who desire to verify the facts here stated and that those who desire information which is not given in this description, will there find there ample means of learning the fullest details.

PROFESSOR WILLIAM O. CROSBY has published an excellent little manual on "COMMON MINERALS AND ROCKS," which is sold by Messrs. Ginn, Heath & Co., of Boston, at 35 cents. A complete set of minerals and rocks named in the work can be had of Professor Crosby for $1, or a more extended set of larger size, including 75 specimens, for $3. With both sets 25 cents is charged for packing.

CORRESPONDENCE.

The Editor does not hold himself responsible for opinions expressed by his correspondents. No notice is taken of anonymous communications.]

CUMBERLAND UNIVERSITY,
Lebanon, Tenn., Jan. 23, 1882.

To the Editor of "SCIENCE."

DEAR SIR—When experimenting with the so-called nitrogen iodine a short time ago, I met with an accident which might have been very serious. I had prepared about a grain of this compound by the action of ammonia upon iodine, and it had stood over night in a watch-glass with a slight excess of ammonia. I proceeded to wash it with water preparatory to drying it for use in the lecture-room. When washing it through the third water and stirring it lightly with a glass-rod to make the cleansing more thorough, a violent explosion took place, filling my face and eyes. I washed them as quickly as I could with water and dilute alcohol, and there followed only a slight inflammation of the conjunctiva, which subsided in a few days.

I have repeated the experiment several times, and in every case have found that when the compound stands in an open vessel for twelve hours under ammonia, it contains a compound which is explosive under water upon slight causes. What this compound is I have not ascertained. At the same time the greater part of substance remains undecomposed and is merely scattered about by the explosion. This when dry presents the phenomena of the ordinary iodine. The subject deserves further investigation,

Very truly yours,

J. I. D. HINDS,

BOOKS RECEIVED.

THE BRAIN OF THE CAT (Felis domestica), a Preliminary Account of the Gross Anatomy, with four plates, by BURT G. WILDER, M. D., Professor of Comparative Anatomy, &c., in Cornell University, &c., &c.

This is a reprint from the proceedings of the American Philosophical Society, July 15th, 1881, and is the first of a series of contributions to the knowledge of the brain of the domestic cat. The present paper is divided into four parts, the second of which is a continuation of the paper by Professor Wilder on "A Partial Revision of Anatomical Nomenclature with especial reference to that of the Brain," published in SCIENCE on the 19th and 29th of March, 1881. Part III. relates to a number of points suggested for study, in which a knowledge of the cat's brain is not sufficiently understood. The four plates are very elaborate and well executed, and describe with great minuteness all that can be seen by natural vision of the cat's brain, both externally and in section. These valuable papers by Professor Wilder promise to mark an epoch in the literature of this subject.

THE THIRTY-SIXTH ANNUAL REPORT of the Director of the Astronomical Observatory of Harvard College, by EDWARD C. PICKERING. Cambridge, 1882.

An abstract of the report will be prepared for "SCIENCE." The report is a cheering one, speaking of the enlarged resources of the Observatory, the increased number of assistants, and efficient work of all engaged in making observations or their reduction.

THE FORMATION OF VEGETABLE MOULD THROUGH THE ACTION OF WORMS, with Observations on their Habits, by CHARLES DARWIN, LL.D., F.R.S., with illustrations. Messrs. D. Appleton & Company. New York. 1882.

As this interesting work will be reviewed in this journal the simple announcement of its publication will suffice.

STUDIES IN ASTRONOMY, by ARTHUR K. BARTLETT, M. D. 2nd edition, revised and rewritten. Published by the author. Battle Creek, Michigan. 35 cents.

As an introduction to the science of Astronomy, this little book presents many advantages, the subject is well handled and presented in a very attractive form.

BULLETIN NO. 1 of the American Museum of Natural History, December 23, 1881. Three articles by Professor R. P. Whitfield, illustrated.

This publication has been produced in a form worthy of the establishment that issued it. It proposes to be one of the most valuable bulletins published by scientific institutions.

BUREAU OF EDUCATION. Circulars of Information, No. 4, 1881; Washington, 1881.

This is an exhaustive description of the work of education in France.

PROCEEDINGS OF THE AMERICAN SOCIETY OF MICROSCOPISTS. Fourth Annual Meeting held at Columbus, Ohio, August, 1881.

This publication, which does credit to the publication committee, contains several valuable papers with seven pages of illustrations, and will be noticed at greater length on another occasion.

HOW TO SEE WITH THE MICROSCOPE, by J. EDWARDS SMITH, M. D.; Duncan Brothers, Chicago.

This book has been severely handled by some critics, but in our opinion it contains more original writing than any book on the subject issued during the last two years, and, coming from the hands of a thorough expert microscopist, merits attention from all using the instrument. The work would be useless to a beginner, who should use Professor J. Phin's excellent little manual, but to one who has made some progress with the instrument Professor Smith's work will prove quite useful.

LUMINOUS INTENSITY OF THE VOLTAIC ARC.

M. Niaudet, in his excellent work, *les Machines électriques à courants continus*, gives quite an exhaustive treatise on the voltaic arc; he particularly dwells upon the arc obtained by a continuous current, the positive pole above, and the negative below and on the same vertical line. It is to this case that the following extract has reference:

"*Relative luminous intensity of the carbons.*—It is very easy to see that the light directed against the lower pole is very much greater than that carried against the top. To see this, it is only necessary to place the two hands, the one above and the other below the arc, and to observe them. The difference is striking.

M. Fontaine has taken a series of photometric measures in a vertical plane, and in all planes varying from the horizontal to the vertical above and below the horizontal plane passing through the arc.

These experiments have proved that the intensity is maximum between 45° and 60° below the horizontal plane, and that it is about ten times greater than the intensity measured at 45° above the horizontal plane. In the same investigation, M. Fontaine has compared the luminous intensities of the voltaic arc furnished by a machine with alternate currents, with those we are now discussing. The same mechanical work was employed in the production of both arcs; the intensity was the same in the horizontal plane; but the mean intensity was much less.

According to M. Fontaine, the mean intensity of the light given by the first arc is three times that given by the second."